

Pathways to High Performance Sustainable Schools

2010 Kentucky High Performance
Sustainable School Workshop
Lexington 03/23/10

Michael Spearnak, AIA



POUDRE SCHOOL DISTRICT



David Patterson

What is it?

Why It's a Good Idea

How to get one

What to do with it once you
get one

The background of the slide is a solid blue color. In the lower right quadrant, there are several faint, concentric circles that resemble ripples on water, centered around a point that is slightly off to the right.

“The Green Team”

We were thinking...



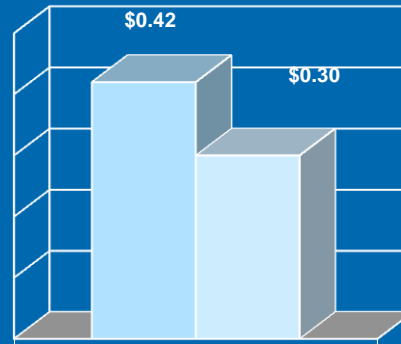
“Green Team”

They were thinking...



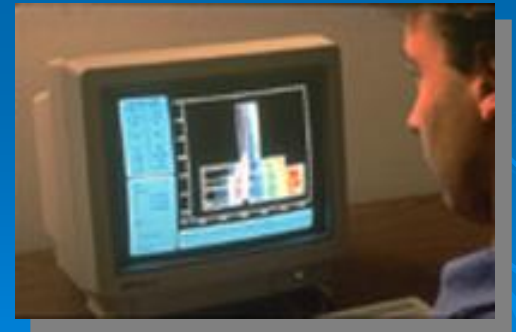
“High Performance”

We were thinking...



Cost per SF

- 1990 Prototype
- 2002 Prototype



“High Performance”

They were thinking...



“Sustainable Design”

We were thinking...



“Sustainable Design”

They were thinking...

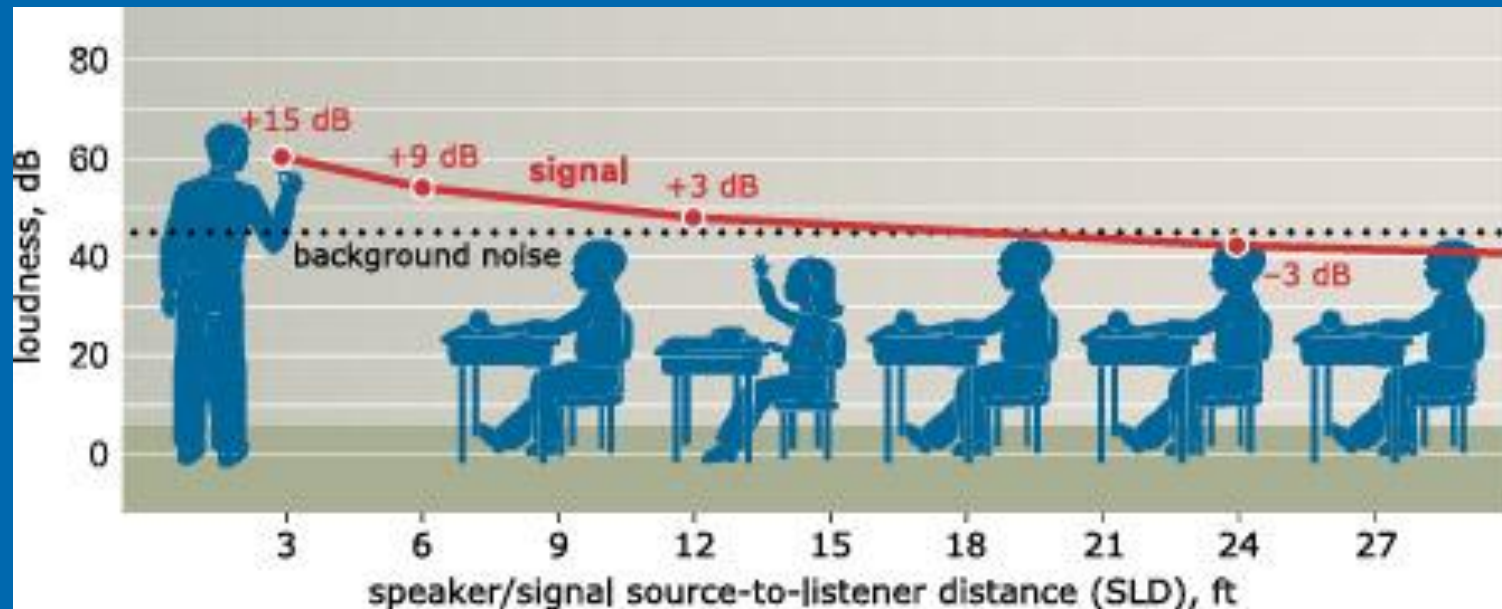


Characteristics of High Performance Schools

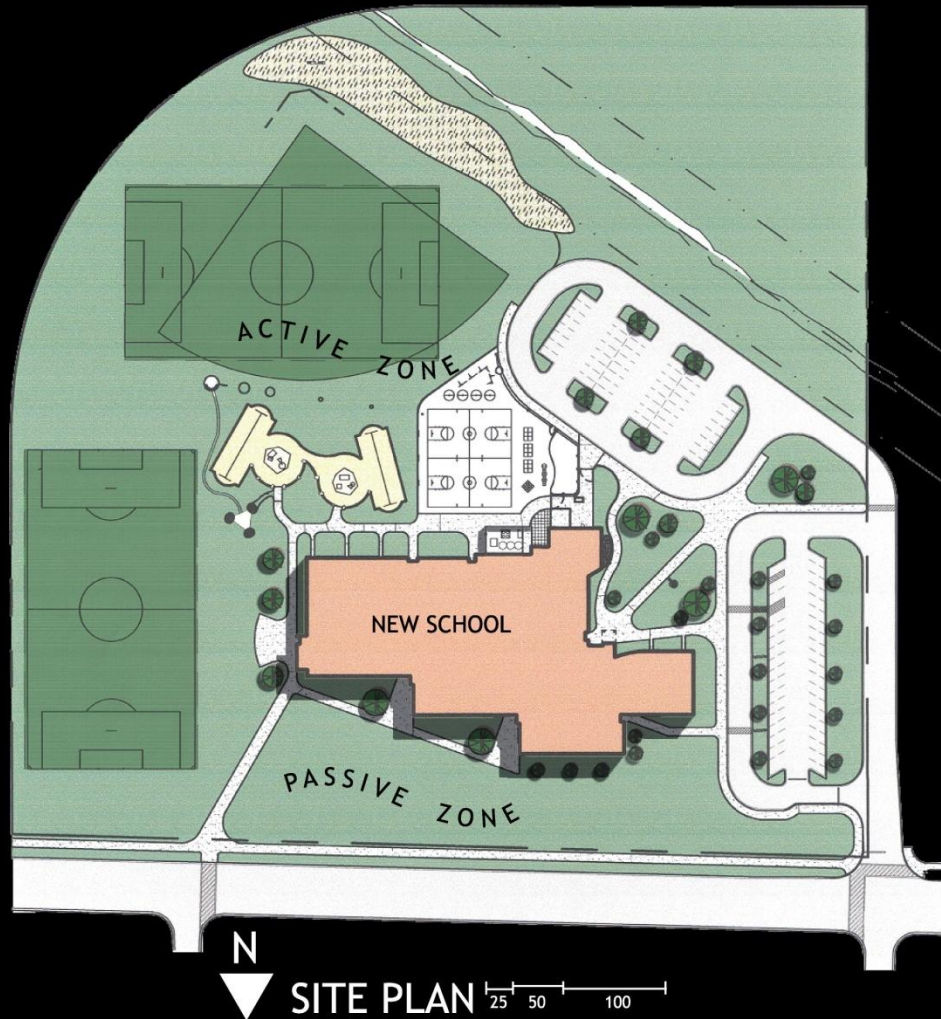
- Indoor Environmental Quality (IEQ)
- Building transparency
- Sustainable Materials
- Buildings that teach
- Daylighting
- Resource/Operating efficiencies
- Supports Human Performance
- Sustainable Sites

Indoor Environmental Quality

- Acoustics
- Ventilation
- Thermal Comfort
- Views/Daylight
- Classroom Lighting
- Low-Emitting Materials
- Indoor Chemical/Pollutant Source Control



- Voice level can drop 75% for a child 12 feet away
- Not uncommon for K-3 student to have less than 50% word recognition more than 12 feet away



Building Transparency





“Visible Learning” at High Tech High, San Diego

NORTH FACING WINDOWS
DAYLIGHT CLASSROOMS

SOUTH FACING WINDOWS
DAYLIGHT CIRCULATION SPACE

MECH EQUIPMENT EXPAND AS
TEACHING ELEMENT

SOUTH FACING WINDOWS DAYLIGHT
KINDERGARTEN ROOMS

SECTION

PSD Prototype Elementary



Sustainable/Low-emitting Materials



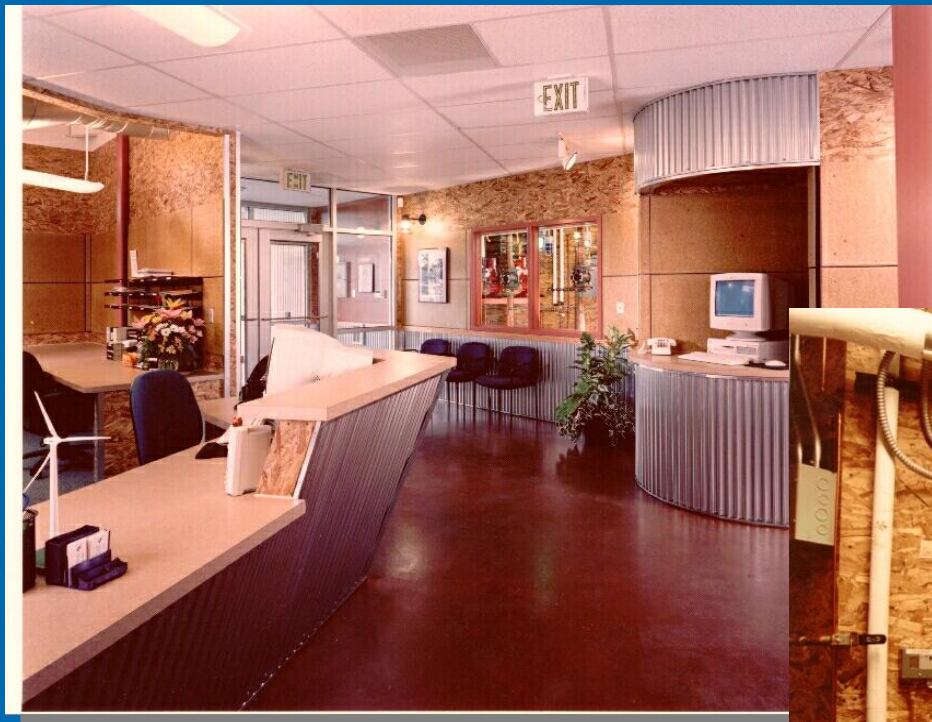
Buildings That Teach



Buildings That Teach



Buildings That Teach



Why Daylight?

Daylighting provides visually superior spaces

Saves money and energy

Good for the environment

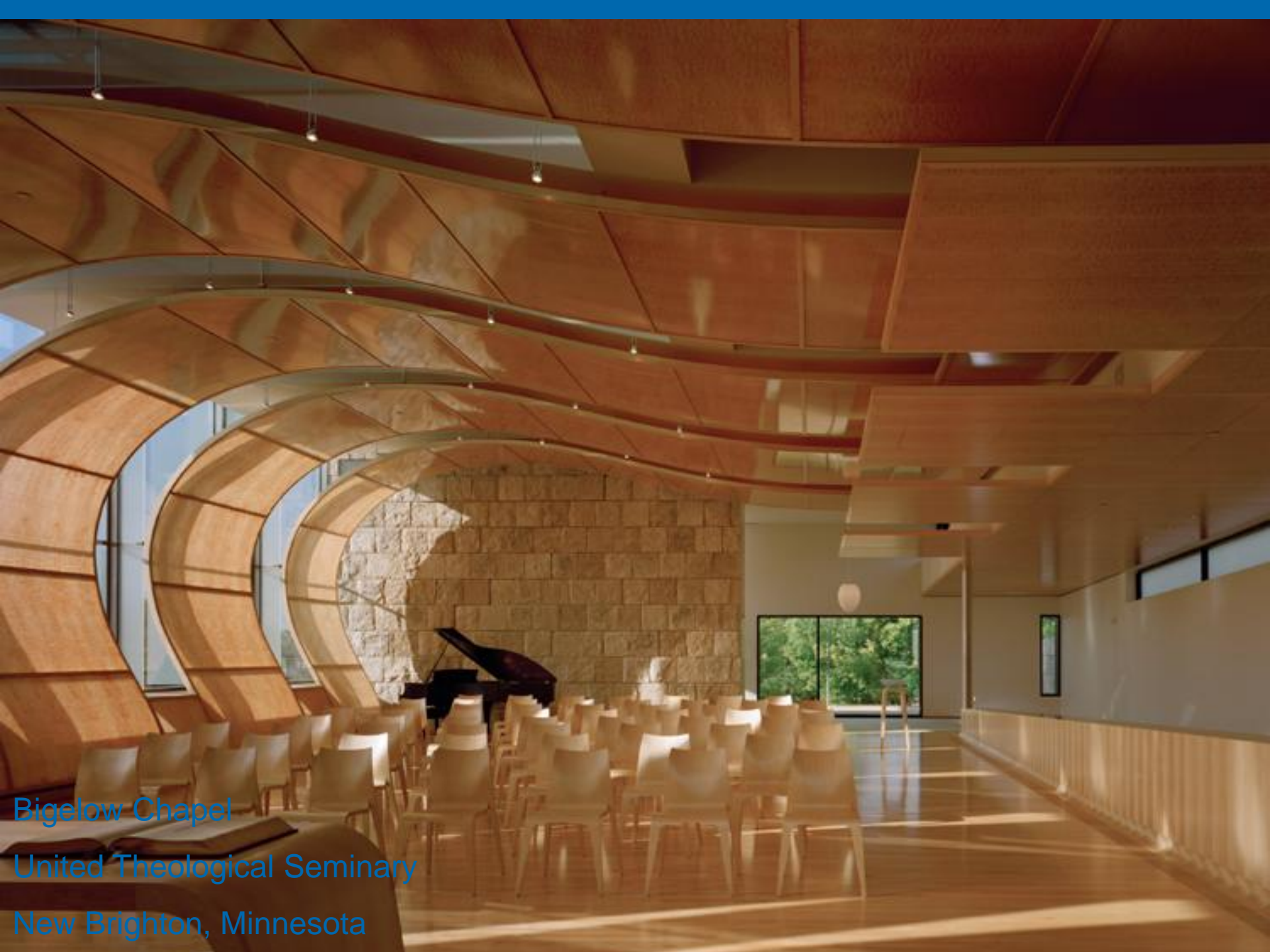
Good for people





www.GreatBuildings.com

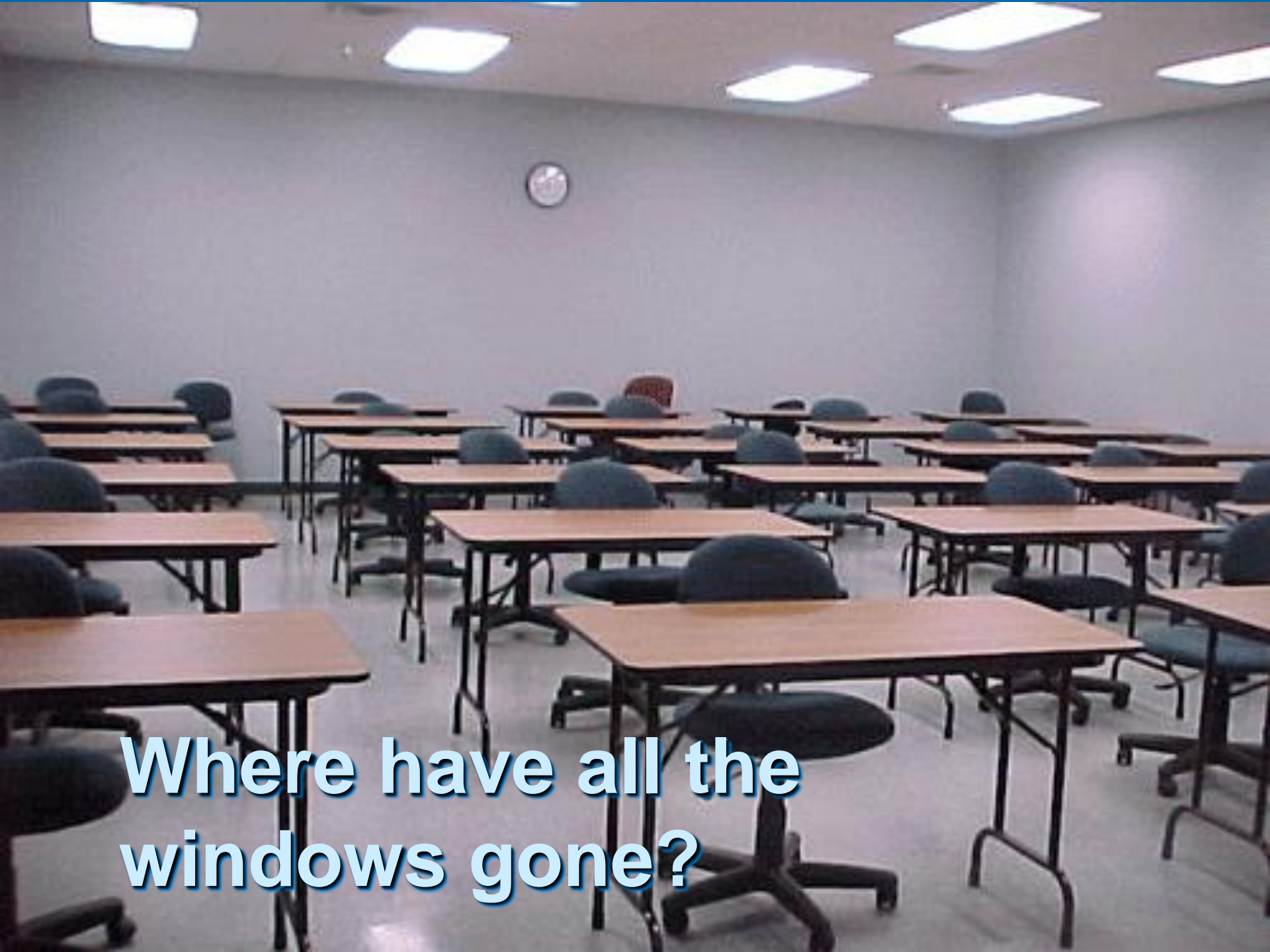
Kimbell Art Museum, Louis Kahn



Bigelow Chapel
United Theological Seminary
New Brighton, Minnesota

Sainte Chapelle, Paris





**Where have all the
windows gone?**





Mesa Verde, Colorado



9.5.2002

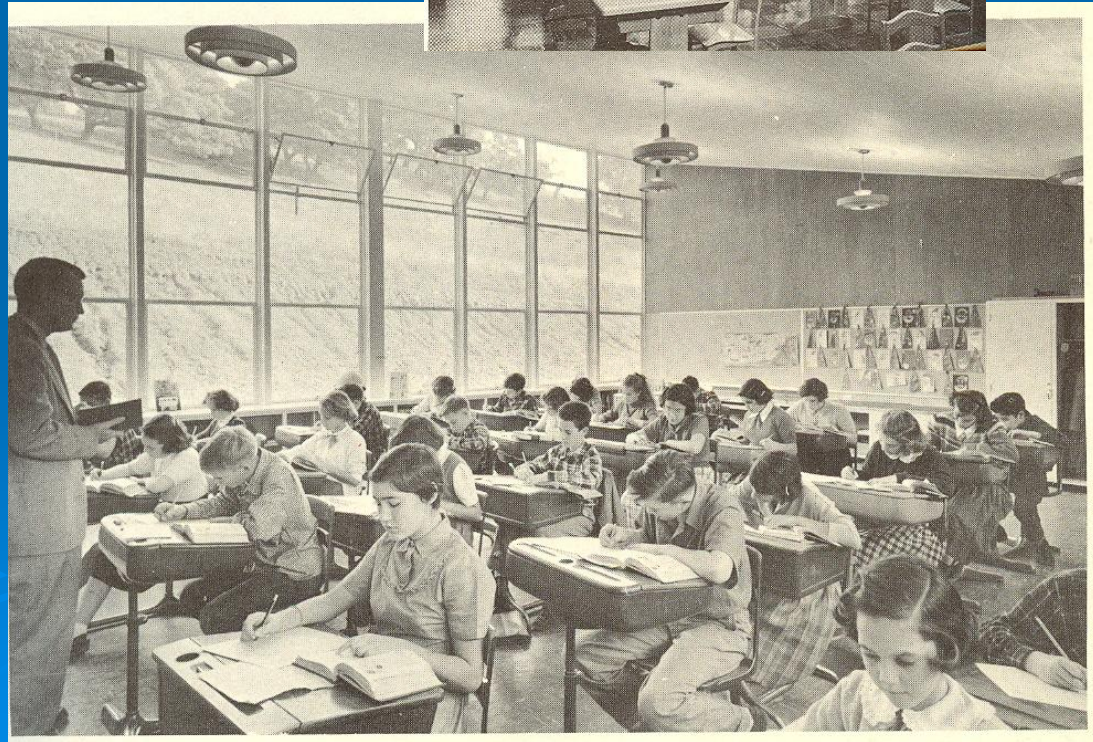
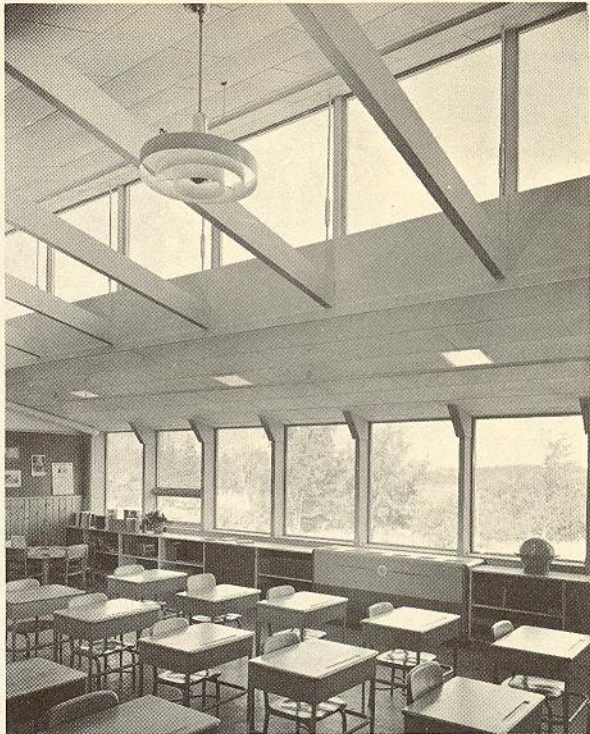
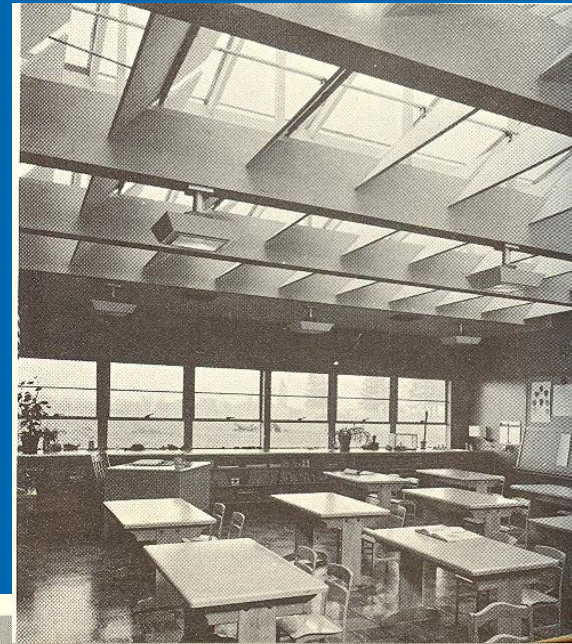
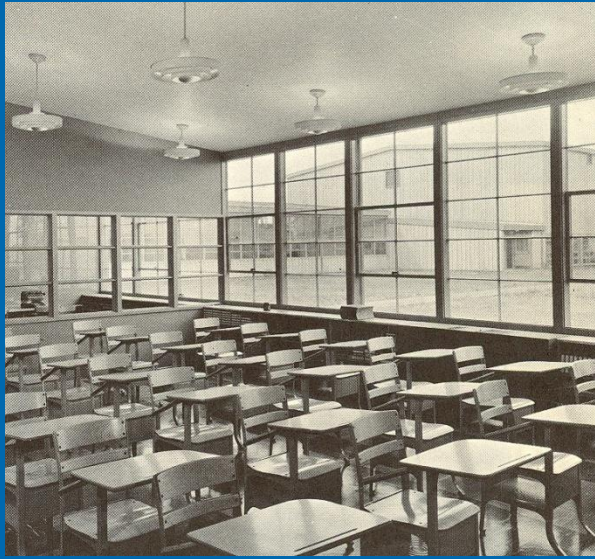




1920's – 1930's



1950's



1970's



1970's – 1980'S



- Work station perpendicular to light source
- Operable window
- High Tvis at clerestory
- Low SC for view glass
- Two levels of shading control
- Low U value
- Reflective interior walls

17th Century Daylighting



Design for daylight

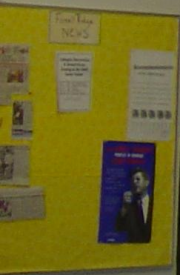
- Shade to prevent glare and heat gain
- Redirect light to where it is needed
- Control the total amount of light :
size, Tvis, exposure
- Integrate with electric light and
architecture
- Daylighting Source Brightness
Control Strategies
- Lower Contrast and Enhance
Uniform Distribution



Plenty of daylight..



Yet the lights burn inside..



2005 11 1

21st Century Daylighting



Redirect Daylight

Balances brightness, reduces contrast, increases visibility
(adjacent classrooms)



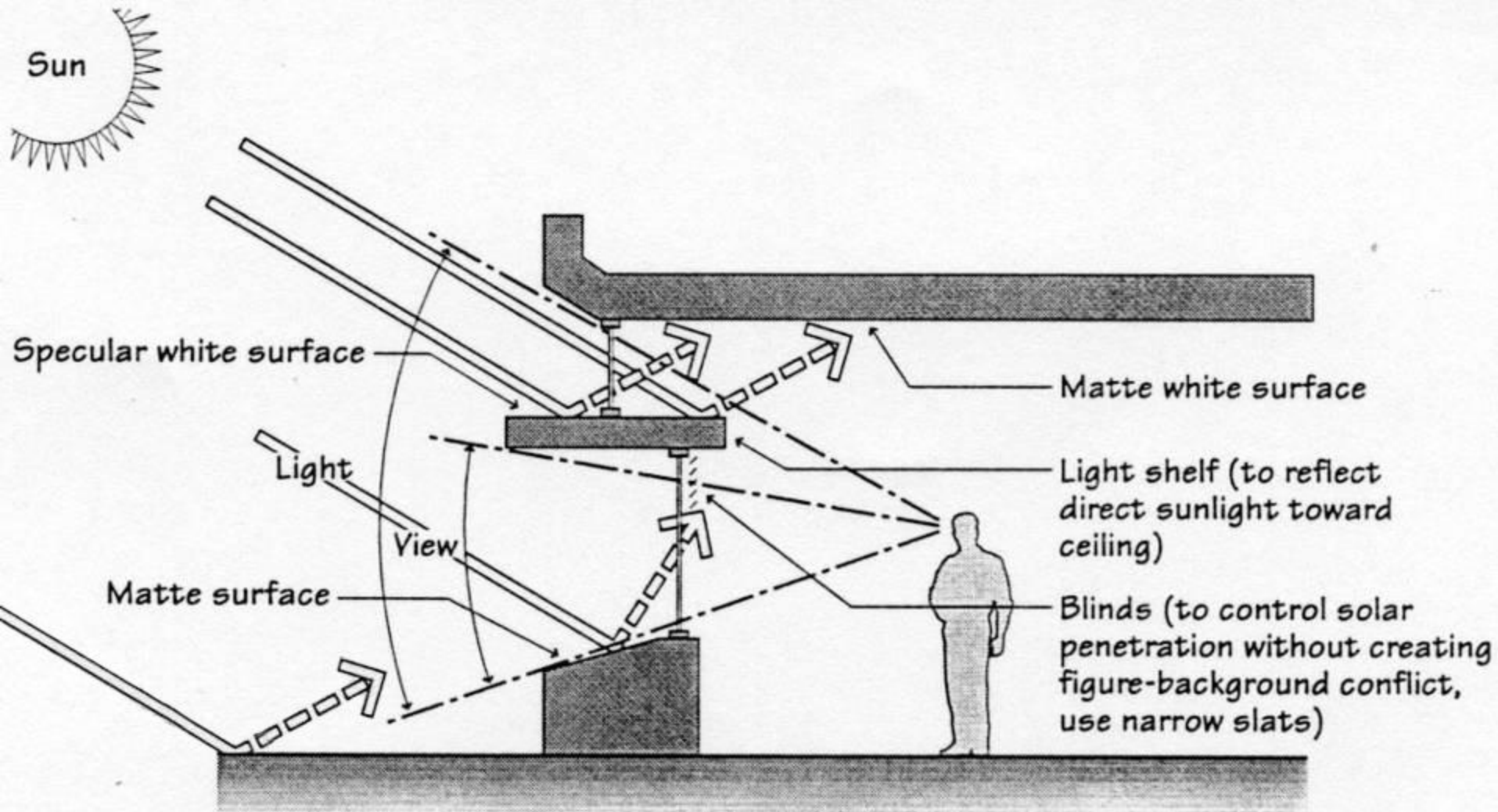
Curitiba School with Light Shelf



Before Light Shelf

Light shelf design

Redirect light, don't reject the light!








If you
don't have
time to
do it right,
you
must have
time to
do it over.






Treat public spaces differently

Integrate with electric light and architecture



A 3D architectural rendering of a room interior. The ceiling is white and features twelve rectangular, recessed lighting fixtures arranged in a 3x4 grid. The walls are light gray, and the floor is white with two dark gray rectangular areas in the foreground. The lighting fixtures are labeled as (12) 3-lamp Parabolic Troffers.

(12) 3-lamp Parabolic Troffers = 1.36 W/sf, plus 2-zone dual switching (18 to 24 ballasts)



A 3D architectural rendering of a room interior. The ceiling is white and features two long, horizontal, recessed lighting fixtures. The walls are light gray, and the floor is white with two dark gray rectangular areas in the foreground. The lighting fixtures are labeled as (12) 2-lamp Dir/Ind (Series 4).

(12) 2-lamp Dir/Ind (Series 4) = 0.89 W/sf, with (6) Motorola 4-lamp dimming ballasts





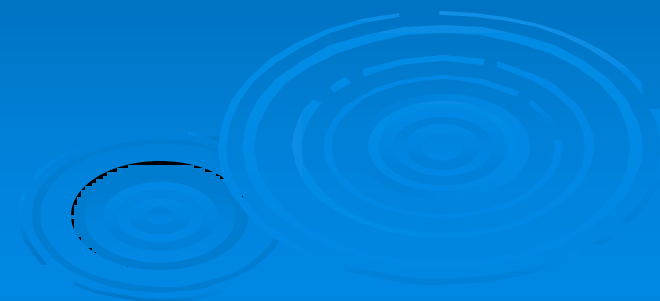
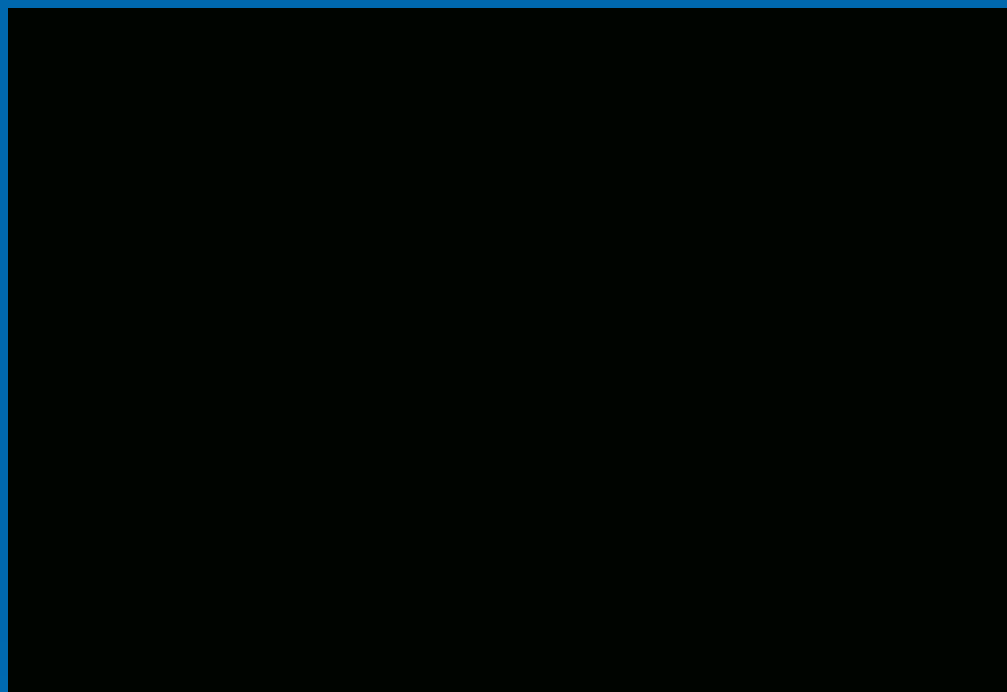
What is it?

Why It's a Good Idea

How to get one

What to do with it once you get one

The background of the slide is a solid blue color. In the bottom right corner, there are several concentric white circles that resemble ripples on water, creating a decorative effect.



High Performance Schools

- Are good for people
- Save money
- Tread lightly on the environment
- Teach

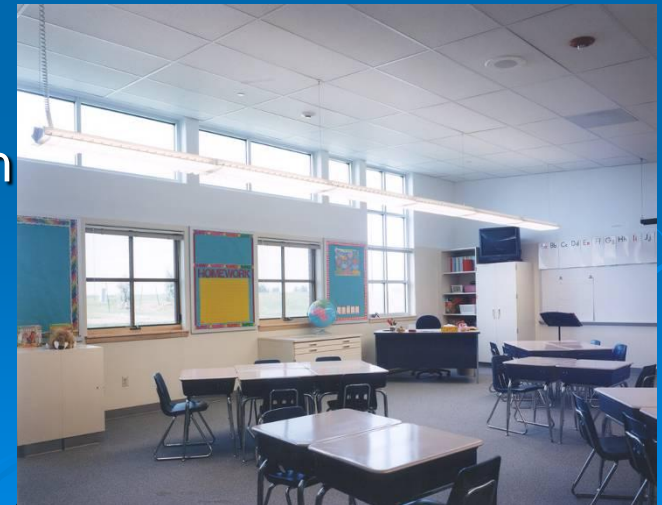


Daylighting and Human Performance

- Increased productivity, performance & satisfaction
- Reduced absenteeism
- Reduced employee turnover
- Increased retail sales

Daylight in Schools

- **Improved Visual Environment**
 - Intensive visual task needs
- **Heshong Mahone Group Studies**
 - Test scores for 21,000 students analyzed
 - Students progressed 20% faster on math tests and 26% on reading in day lit classrooms
 - Operable windows improved progress by 7-8%
 - Views increases satisfaction and attention
 - Observed with 99% statistical certainty



Capistrano Unified School District

Orange County, California

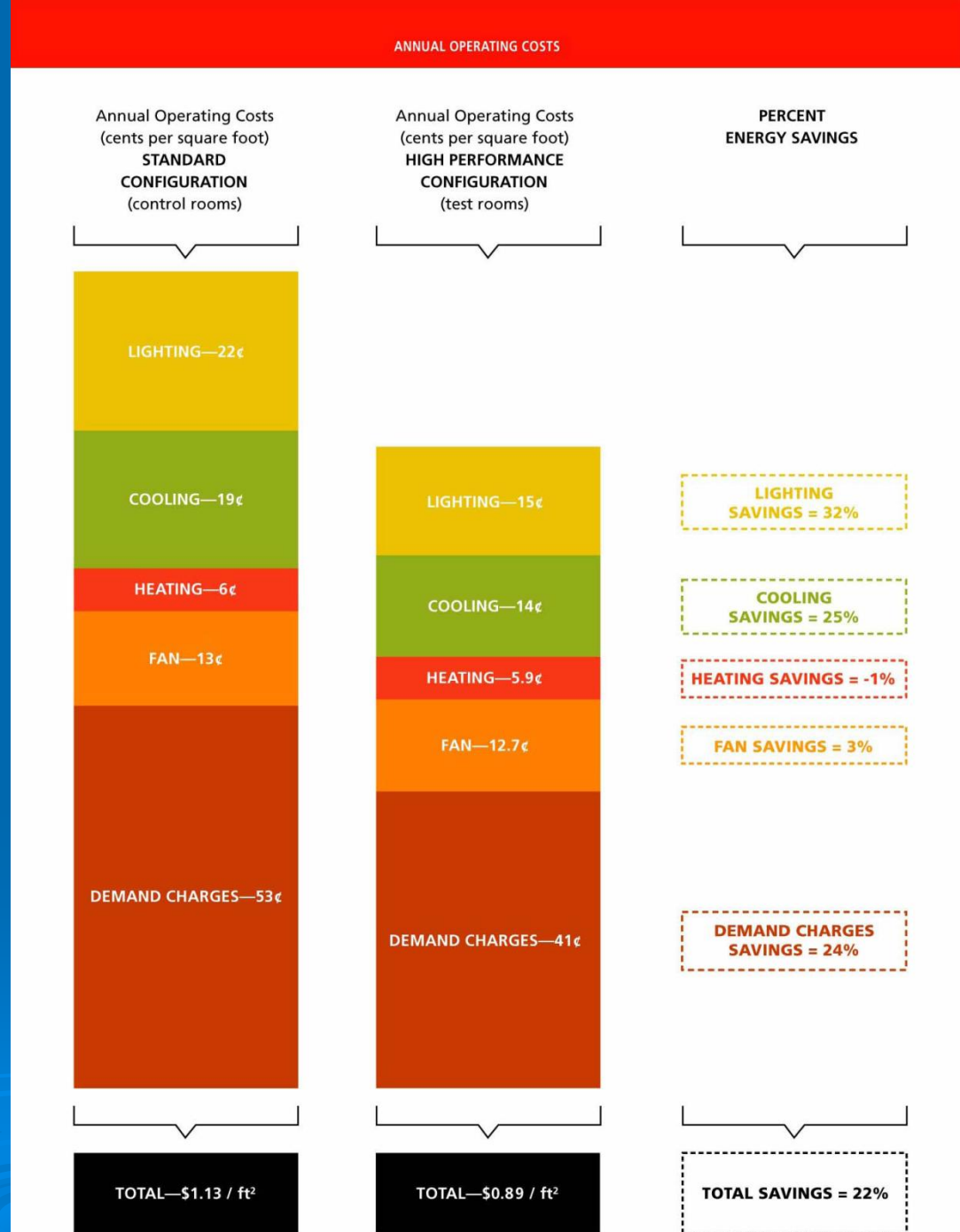
- Classrooms with the **most daylight** had a **20% to 26%** faster learning rate
- Classrooms with the **most window area** had a **15% to 23%** faster learning rate
- Classrooms with **diffusing skylights** had a **19% to 20%** faster learning rate
- Classrooms with **non-diffusing skylights** (causing patches of light and glare) had a **21% decrease** for reading tests and no significant results for math tests
- Classrooms with **operable windows** had **7% to 8%** faster improvement compared to classrooms with fixed windows

Heshong Mahone Group. *Daylighting In Schools*. August 20, 1999. www.h-m-g.com

Daylight Collaborative

www.daylighting.org

High Performance Schools Save Money



Construction Cost Savings

- Synthetic Tiles vs. Face Brick
- Reduced storm water fees
- Reduced electrical/water service
- Reduced Loads: Chiller vs. Ice Storage
- Exposed Structure
- Reduced Hard Surface, Less Sod
- Smaller Footprint
- Donated Materials
- Contractor Familiarity

kBtu/sf/yr

Click
here
to
updat
e

2006
2007
2008
2009

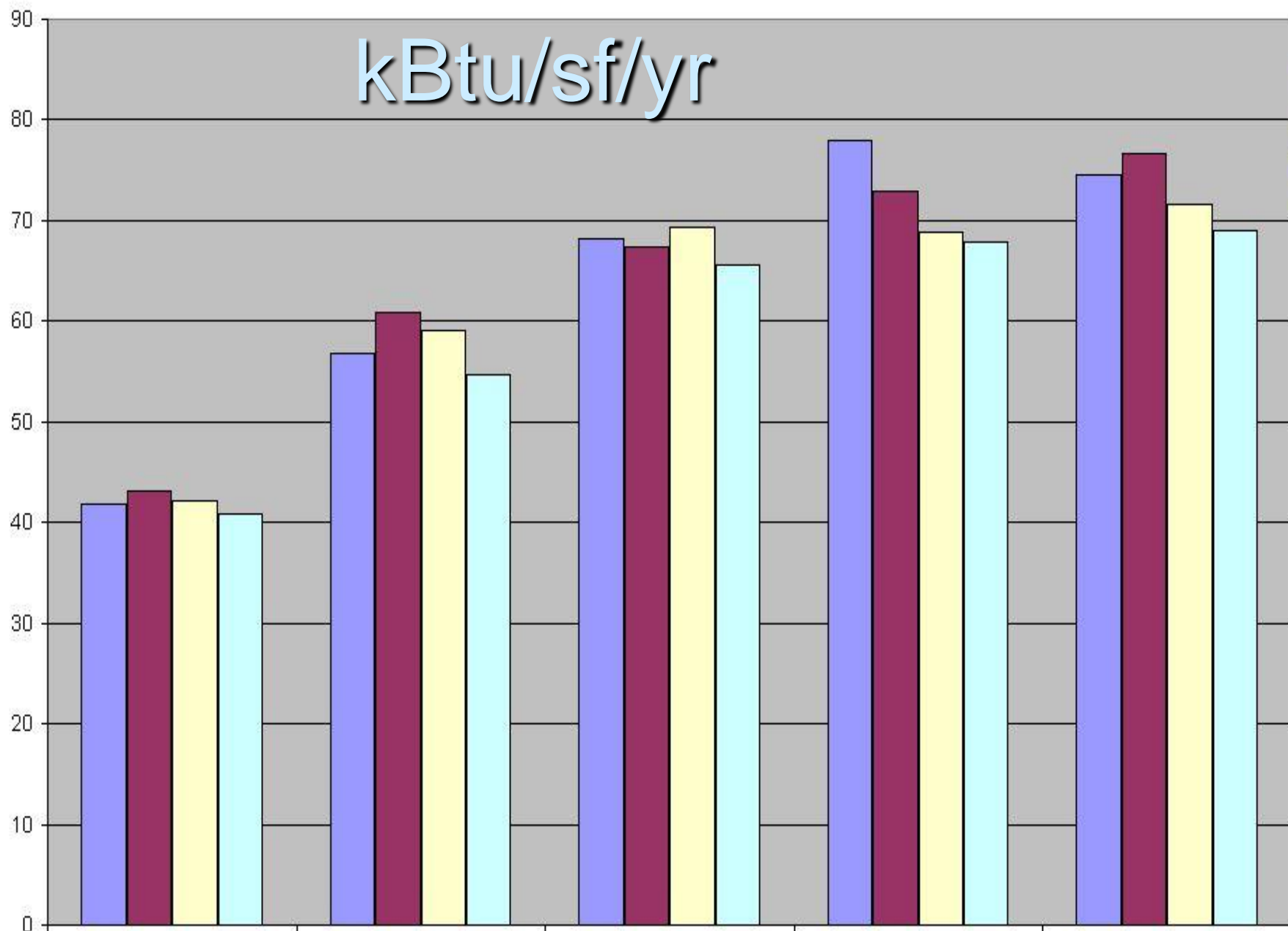
FRHS
High

CENTENNIAL

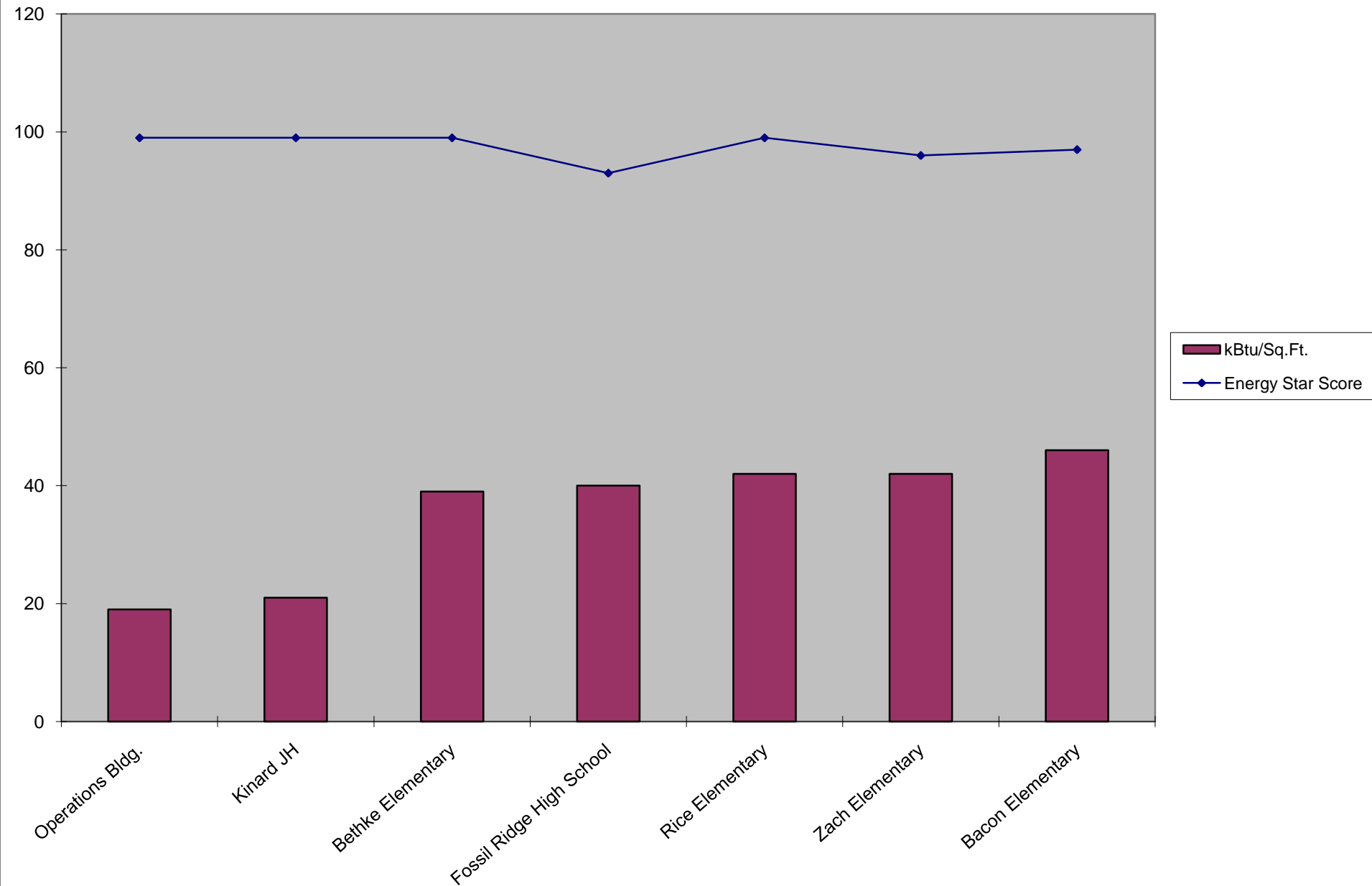
RMHS

FCHS

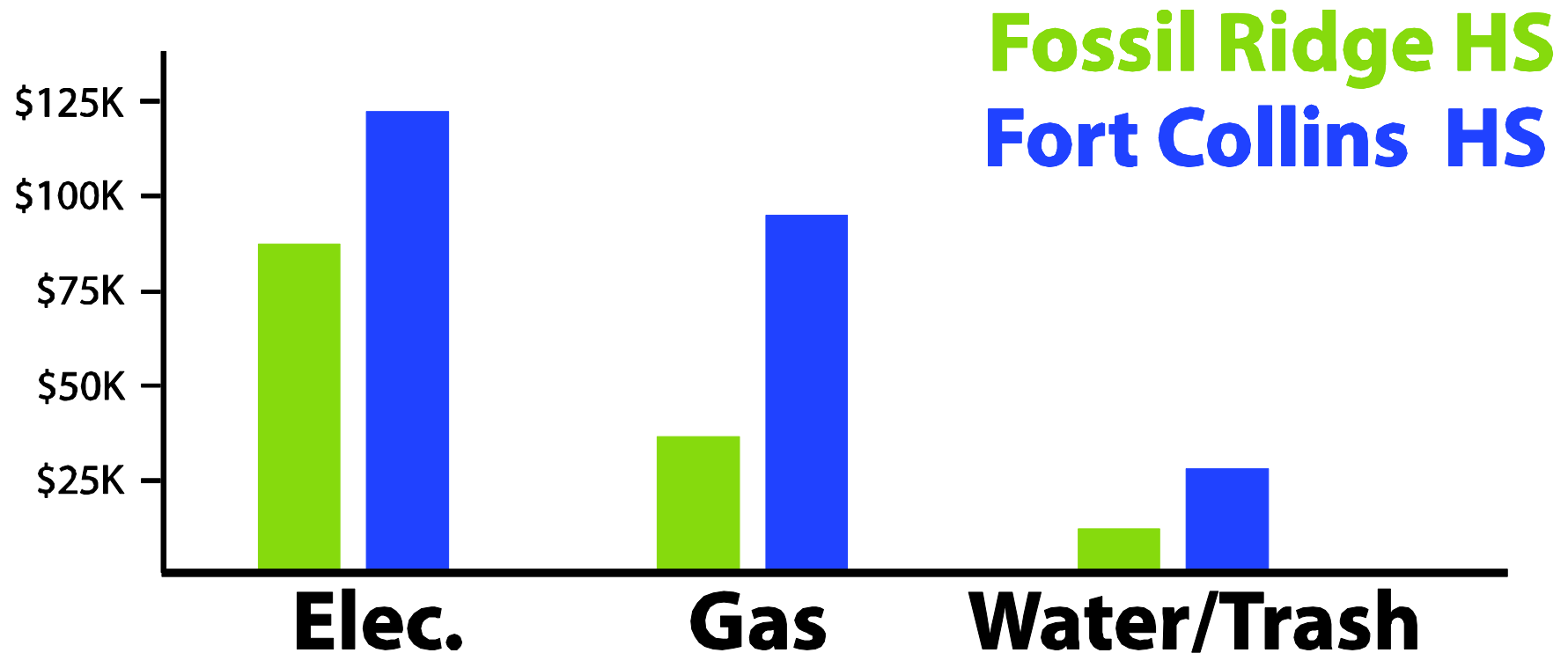
PHS



HIGH PERFORMANCE SCHOOL ENERGY USE INFORMATION



Annual Energy Comparison 2004 - 2005



Total first year savings : \$105,310 or 2.6 teachers

Sustainable Energy Strategies

- “Micro-Loaded” Building
 - Thermal Ice Storage
 - Daylighting/Controls
 - Occupancy Sensors
 - CO² Sensors
 - Super Insulation
 - Electronic Ballasts & T-8 Lamps
 - Energy Management System
 - Variable Frequency Drive Motors
 - Shared Raw Water Irrigation System
 - HVAC Reheat System
 - Operable Windows
- 
- The bottom of the slide features a decorative graphic of several concentric circles, resembling ripples on water, in a lighter shade of blue against the main background.

Nuclear Reactor at Remote Location

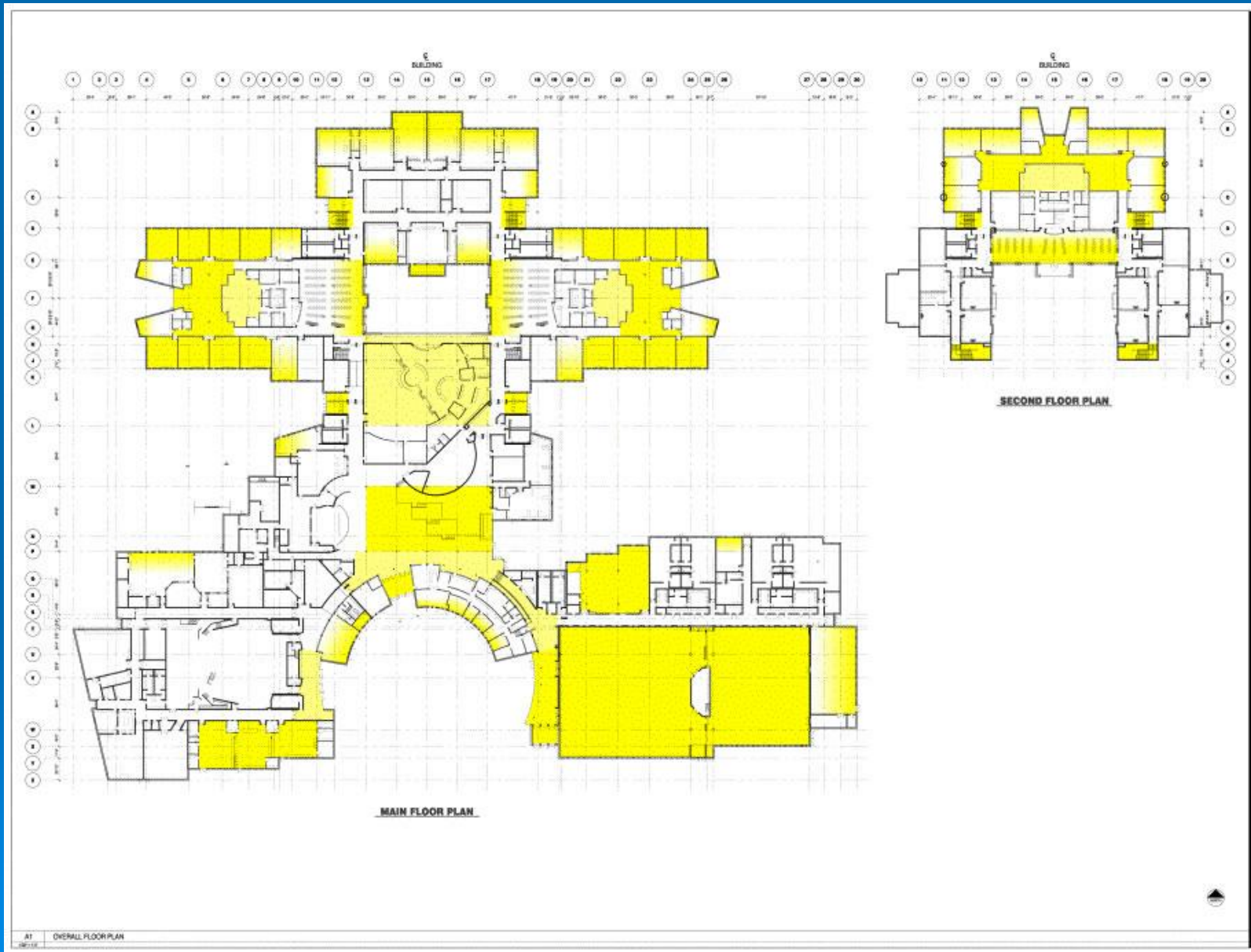


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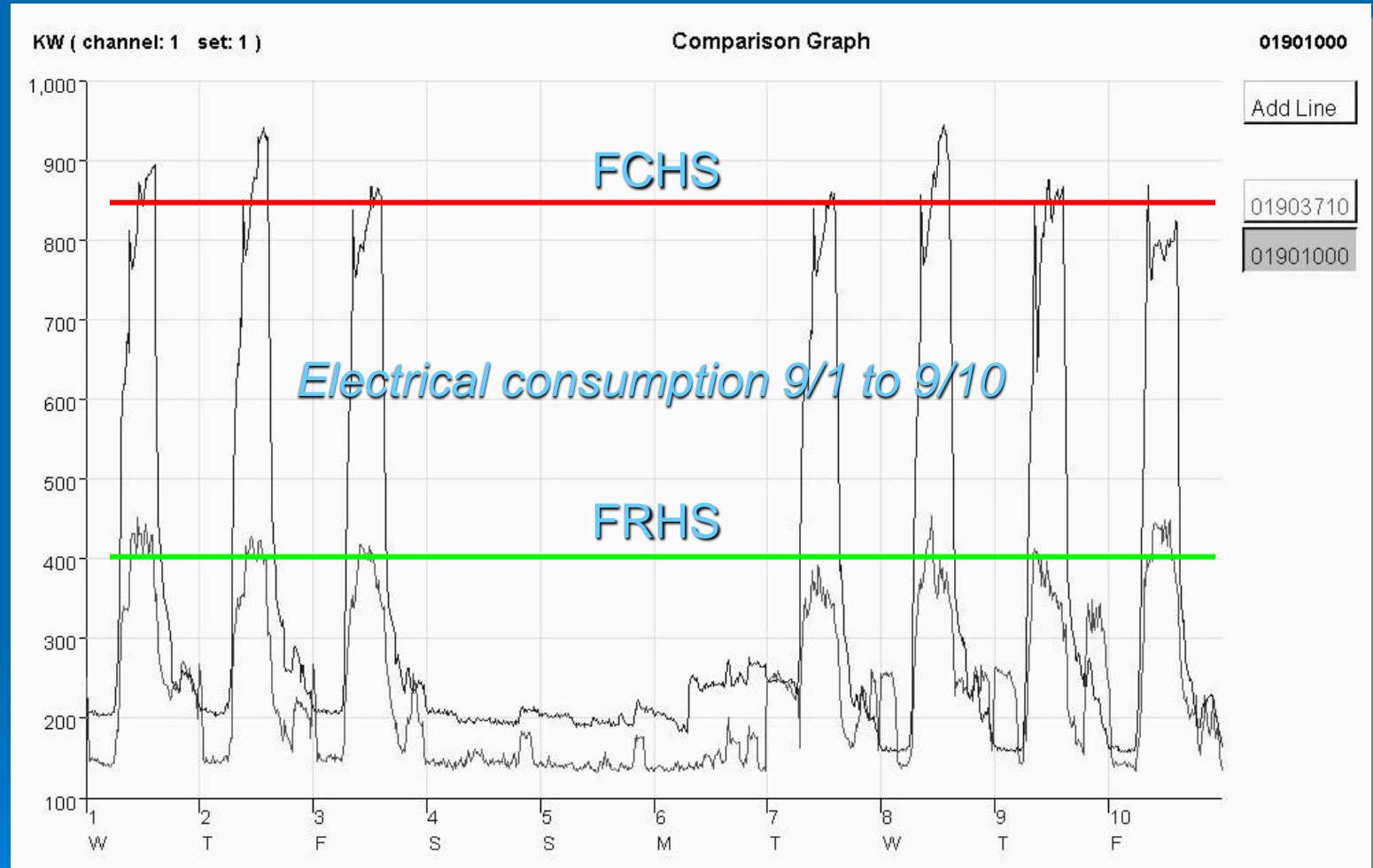
PV Panels make a public statement and do double duty providing shade...



Nuclear Reactor Power



FRHS vs FCHS



Ice Storage



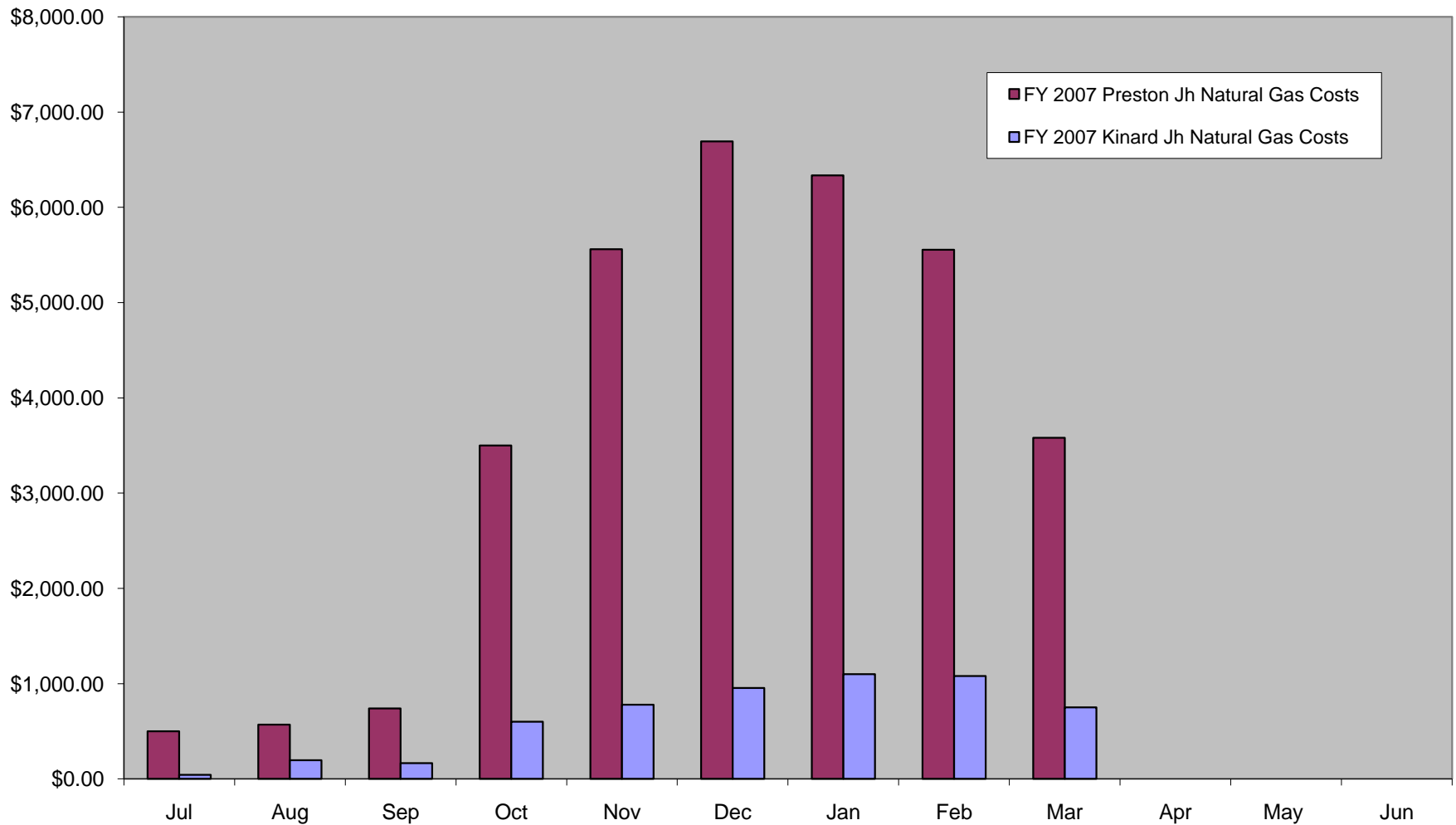
Geoexchange System

- 100 Wells (300' deep)
- 71 Heat Pumps



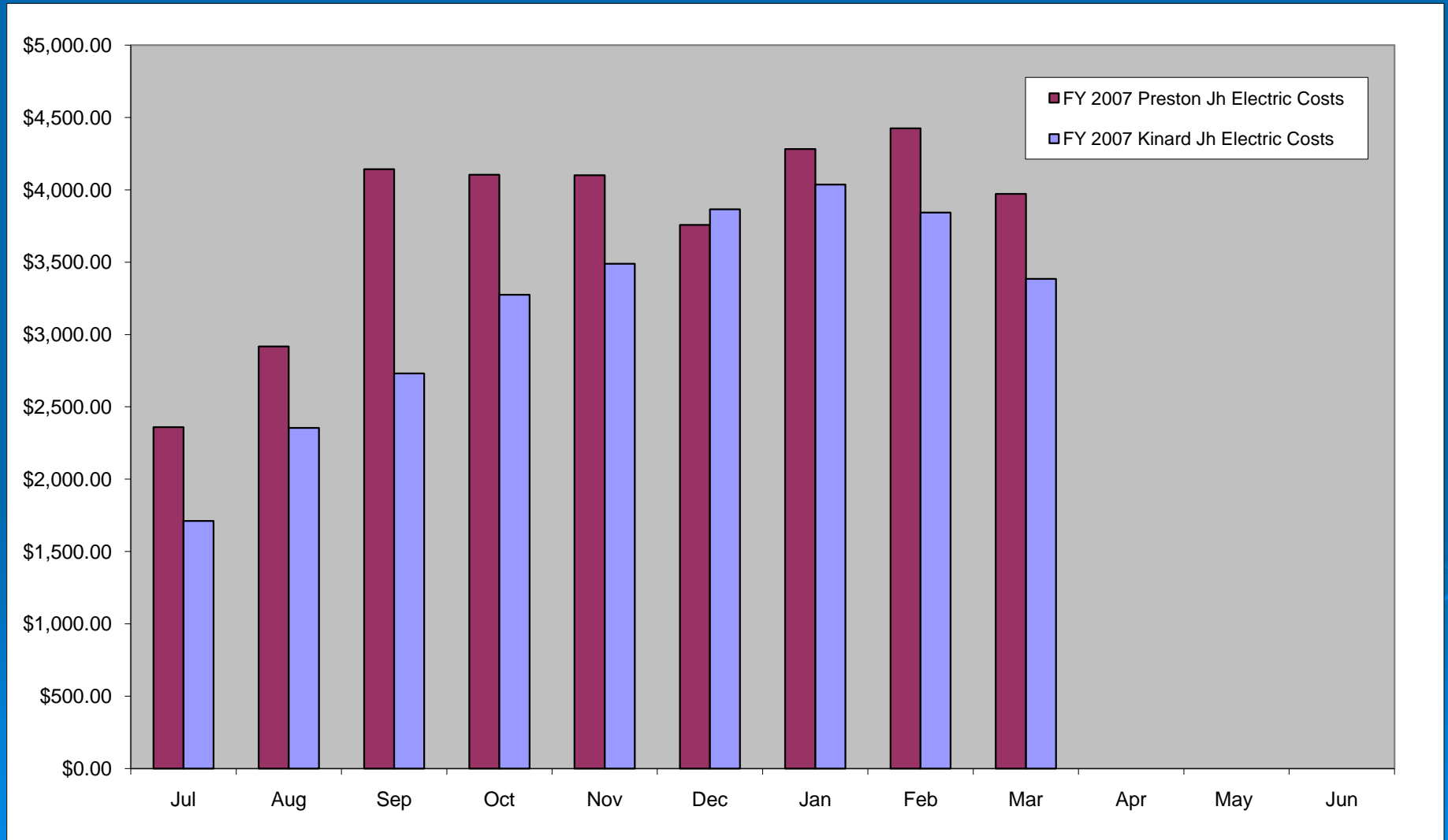
PJH vs. KJH

FY 2007 Natural Gas Costs



PJH vs. KJH

FY 2007 Electric Costs



Sustainable Design & Site Planning



KINARD JR. HIGH
FORT COLLINS, COLORADO



BHA Design Incorporated
4823 Innovation Drive
Fort Collins, Colorado 80525
Phone: 970.223.7577
Fax: 970.223.1827

Gravelpave²





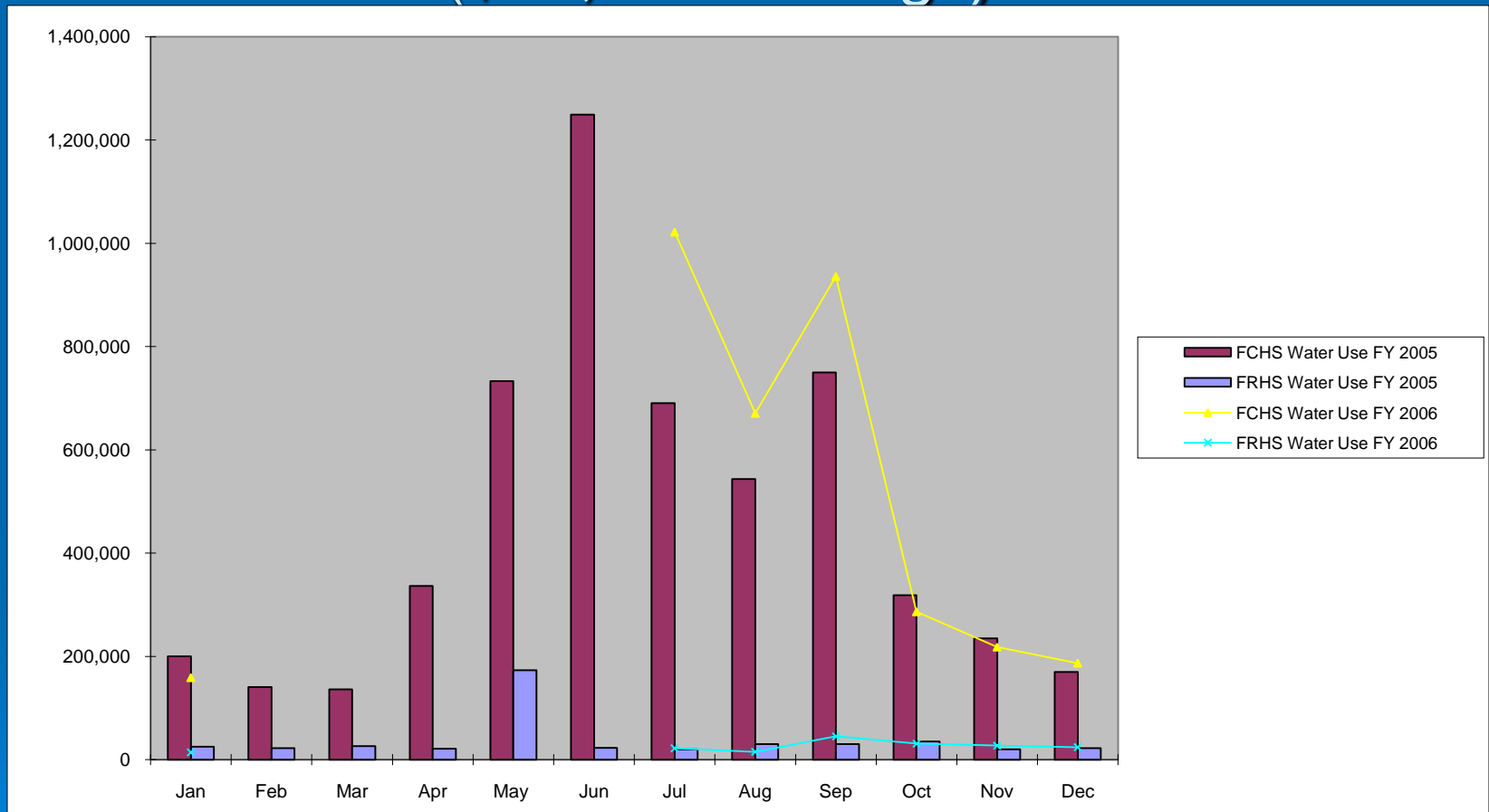
*Synthetic
playfield...*

*Raw water
irrigation...*



Water Cost

July 2004 – Jan. 2006
(\$19,727 Savings)



Wind Powered



Other PSD Buildings:

Operations Center

Bacon Elementary

Fossil Ridge High School

Kinard Junior High School

Rice Elementary School

2008 Elementary (Timnath)

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How to get one

What to do with it once you get one

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A school designed to “Code” is the worst facility you can legally build.

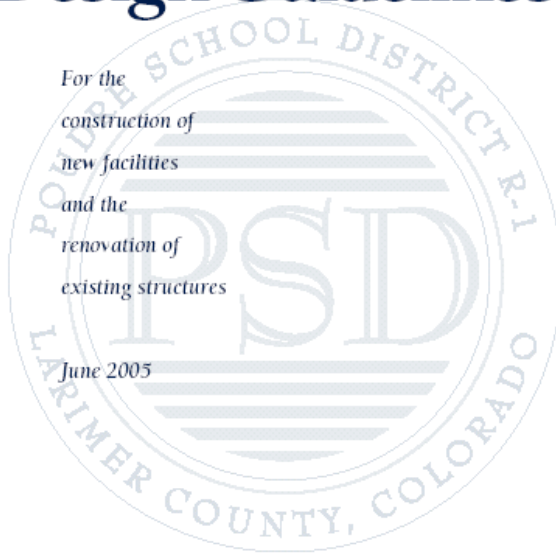


Write your own “code”

Sustainable Design Guidelines

For the
construction of
new facilities
and the
renovation of
existing structures

June 2005



Operations

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Ask for what you want

- Reduction in Cooling Load...1 Ton/1000 s.f.
- Reduction in Heating Load...Energy Star 75 or better/Beat ASHRAE 90.1 by 60%
- Reduction in Operating Costs...Beat PSD's best performer
 - Flexibility... • Increased Attendance...
 - Increased Productivity & Achievement...
 - Improvement in Health & Healing...

Find someone willing to take the blame

FOULDER SCHOOL DISTRICT
Mike J. J. Spatz, District Architect
2067 L. Pomeroy Avenue
Fort Collins, CO 80521
(970) 226-1111 - OFFICE
(970) 226-1212 - FAX



MEMO

To: _____ From: Mike Spatzak

From: _____ To: _____

Phone: _____ Date: May 5, 1999

Re: BUILDING PROTOTYPE CC: File

☐ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply

Help!

I need people for a committee. This one, however, will be different. The ideas generated by this committee will have long ranging effects on thousands of lives long after we are gone. Millions of dollars will be spent implementing these ideas! Tangible results will be visible in just a few years. And best of all, I will take the blame if these ideas don't pan out!

This is the BUILDING PROTOTYPE

VISION: DESIGN BUILDINGS THAT TEACH

VISION: DESIGN BUILDINGS THAT ARE "GREEN"

VISION: DESIGN BUILDINGS THAT ARE COST-EFFECTIVE

The goal of this committee will be to generate design principles that will help achieve these visions. These design principles will guide the Educational Specifications architect and their consultants will use for schools.

Members of the committee will be responsible for doing no more than research information for presentation to the committee. Areas of research:

Energy and Conservation Issues

HVAC Systems

Electric Motors and Drives

Lighting

Electrical Power Systems

Office, Food, and Laundry Equipment

Building Shell

Renewable Energy

Water and Wastewater

Water Management

Site and Landscaping

Indoor Environmental Quality

Help!

I need people for a committee. Yes, that's right, another committee. This one, however, will be different.

The ideas generated by this committee will have long ranging effects on thousands of lives long after we are gone. Millions of dollars will be spent implementing these ideas! Tangible results will be visible in just a few years. And

best of all, **I will take the blame if these ideas don't pan out!**

Champions

- Encourages Creativity
- Any level/position
- Empowering



Involve everybody... Who invited you?



The Architect's Dream
1840 Thomas Cole









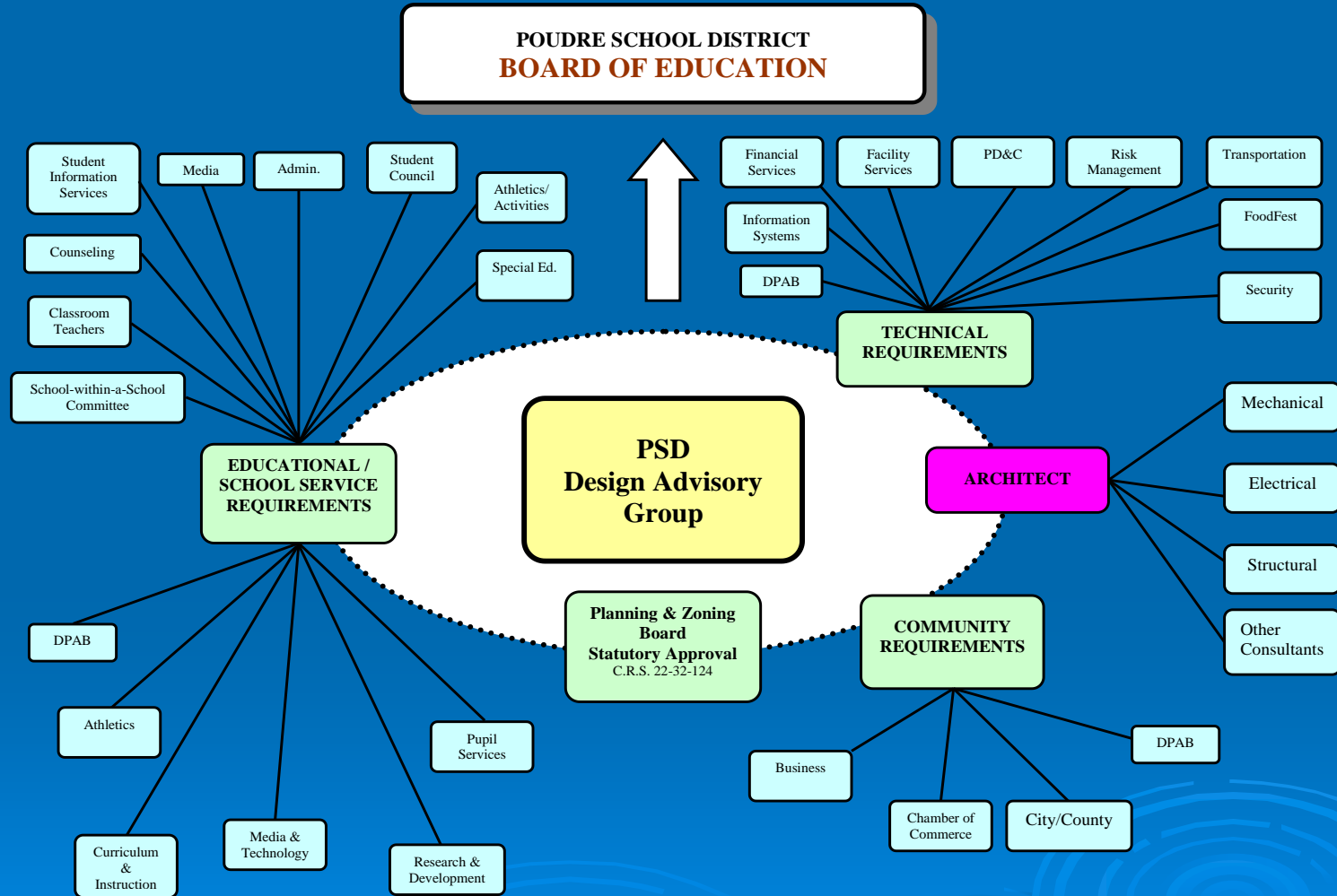
Not-So-Integrated Design Team



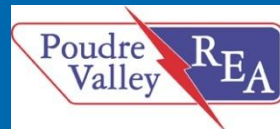
Integrated Design Team



Stakeholders



High Performance Partners



Consequences of Not-So-Integrated Design





Integrated Design



No-So-Integrated
Design

Integrated Design

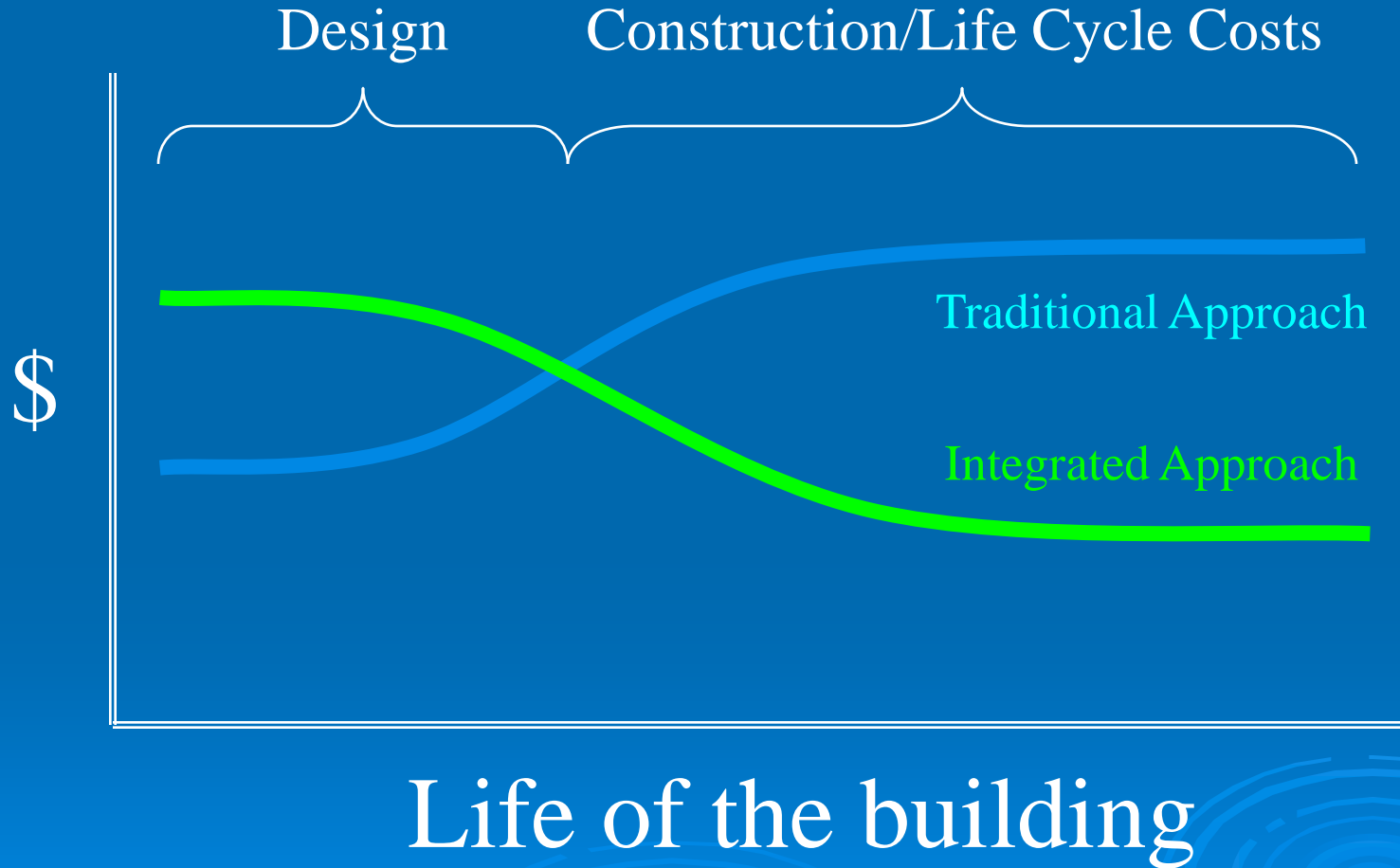


“The bitterness of poor quality remains long after the sweetness of low price is forgotten.”

Benjamin Franklin



You Get What You Pay For



What is it?


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What to do with it once
you get one

The background of the slide is a solid blue color. In the bottom right corner, there are several concentric white circles that resemble ripples on water, creating a decorative effect.





A row of seven condiment tubes is displayed on a shelf. From left to right, the tubes are yellow, yellow, green, blue, blue, red, and red. The second yellow tube is labeled 'Mustard', the green tube is labeled 'Relish', the first blue tube is labeled 'Jell-O', and the first red tube is labeled 'Ketchup'. The tubes are arranged in a slightly staggered fashion, with the red tubes being the most prominent on the right.

Mustard

Relish

Jell-O

Ketchup

Lessons Learned

- Talk to the users
- It doesn't have to cost more
- Involve the students and staff
- Change the culture
- Clean green
- Facilities support/training is critical
- Commission!



Commissioning

- Intent: *Verify and ensure that fundamental building elements and systems are designed, installed and calibrated to operate as intended.*
- Independent third-party hired by the Owner.



- Key member of an “integrated” design team...

Integrated Design....

- Don't try it by yourself...
- Invite your enemy in...
- Find out something about the folks on your team...
- Go on a field trip...
- Ask for what you want...
- Stay focused...
- Listen to others...
- Admit you don't know everything...
- Share...
- Test it before you build it...
- Find somebody to blame if it doesn't work out...

Sustainability Management System

- Support its educational mission by providing physical spaces that promote the health, productivity, and safety of students and staff.
- Reduce life-cycle costs by conserving energy and natural resources, further supporting educational mission through fiscal responsibility.
- Balance educational, financial, and environmental issues in daily decision-making.
- Consider and incorporate relevant aspects of sustainability into all future policies.
- Inspire commitment to this policy among employees.
- Serve as a community leader in sustainability and partner with other organizations to further common goals.

Sustainability Management System Team

- Building Maintenance
 - Channel 10
 - Communications
 - Curriculum
 - Custodial
 - Customer Support
 - Finance
 - Food Services
 - Human Resources
 - Information Technology
 - Outdoor Services
 - Purchasing and Materials Management
 - Records
 - Risk Management
 - Security
 - Staff Development
 - Transportation
- 

Recognition

- Colorado Renewable Energy Society
- US Environmental Protection Agency
- US Department Of Energy
- Rebuild Colorado, Rebuild America
- American Institute of Architects
- American Society of Interior Designers
- American Association of School Administrators
- Council of Educational Facility Planners, Int.
- National Renewable Energy Laboratory
- Governor's Office, State of Colorado
- City of Fort Collins, CO
- Larimer County, CO
- North Front Range Solid Waste Action Group

Organization change in the direction in which they inquire...



A Few Of Our Friends



Thank You!



POUDRE SCHOOL DISTRICT

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